Observer Profile – John Toone

Early Days 1968 - 1972

I recall watching the TV broadcast from the Apollo 8 crew orbiting the moon on Christmas Eve 1968. This stimulated sufficient interest in me to request that my parents get me up at 5am on 21 July 1969 to watch Neil Armstrong step onto the lunar surface. I was a bit miffed to learn that the event had been accelerated and I had to be content with watching the repeat broadcast at an inclement hour. Despite this I had developed a curiosity about the moon and the planets and in spring 1970 that curiosity was enhanced during a school project. The project was for each 9 year old child to create a scrapbook on any subject they wished and the one judged to be the best by the teacher would receive an Easter egg as a prize. With chocolate as an incentive I chose the planets as the subject and proceeded to cut out from my parents wedding gift encyclopedia all astronomy related subject matter. The scrapbook was swiftly compiled (I still have it), the Easter egg was secured and my interest in astronomy had become established. In 1971-1972 I satisfied my growing thirst for knowledge by collecting all information I could find on astronomy from school and local library books and compiled my own reference scrapbooks. Seeing that my interest in astronomy was sustained, my parents forgave me for butchering their encyclopedia and for Christmas 1972 they purchased me a 6cm refractor telescope. On 25 December 1972 I made my first 'observation' with the telescope. After hastily assembling it without following the instruction manual, I pointed it at the brightest star I could see through my bedroom window. It appeared to be a disk so I mistakenly thought it was a planet and made a drawing. The following day I discovered the telescope focus mechanism and realised that I had been looking at a star (probably Altair). Although completely useless the drawing was a reasonable representation of a defocused star so my observing career had technically commenced with an important first step; I had recorded exactly what I saw.

Planetary and Deep Sky Work 1973 - 1982

In 1973 I obtained a Philips Planisphere during a school trip to Jodrell Bank and became familiar with the constellations. I identified the bright planets and started to draw them as they appeared in the 6cm refractor. There was a close opposition of Mars in 1973 and I clearly saw brown markings on its small orange/red disk. The phases of Venus, cloud belts of Jupiter and rings of Saturn were all drawn. I picked up the Galilean satellites and was surprised to see how quickly they changed position from night to night. In 1974 I was not happy with the level of detail shown on the star charts at my disposal so I drew my own based upon tracings from the local library star atlas. Geometrical & Engineering Drawing was my best subject at school and this skill was fully harnessed in astronomy later on, particularly in deep sky and variable star work. In September 1974 I joined the local astronomical society based in Salford. They had an observatory equipped with an 18 inch reflector which afforded me much clearer views of the bright planets. Salford Astronomical Society also had a very active Messier Objects Section (SAS MOS) which I soon joined and I started to make observations (drawings) of deep sky objects, some of which ended up being included in the Webb Society Observing Handbooks. My first deep sky observation was of M41 on 20th January 1975 (easy to find directly below Sirius)

and the last was of the LMC on 22nd September 1982 which was published in the February 1986 edition of Sky & Telescope. All of the Messier Objects were observed from the UK although I had to travel to Cornwall to pick up the most southerly which was M7. The visual techniques learned in observing deep sky objects would stand me in good stead in the future with variable stars and AGN's. The SAS MOS frequently organised observing projects and camping trips to darker areas of the country and were an excellent group of personnel to be involved with at this formative stage of my observing career.

Early Variable Star Work and Comets 1975 - 1976

I made my first variable star observation on the 4th January 1975. It was of Mira at magnitude 8 using 12x50 binoculars which I had commandeered from my brother who had obtained them for horse racing but had lost interest. These binoculars were put to good use because over 50,000 variable star observations were made before they fell apart and had to be replaced 31 years later. I observed R CrB at maximum on 9th May 1975 and then saw Chi Cyg having a particularly bright maximum at magnitude 4.2 on 23rd May 1975. On the 18th July 1975 I made my 10th variable star observation which was also of Chi Cyg and whilst doing so noted a nebulous object just 2 degrees NP Eta Cyg that was not shown on Nortons Star Atlas. This turned out to be Comet 1975h discovered just 10 days earlier. Six weeks later on the last night of the school summer holiday I was among dozens of people who detected Nova (V1500) Cyg independently. Then on the 31st July 1976 I was on a camping trip on the Pennine Mountains with the SAS MOS and picked up Comet d'Arrest 1851 II in binoculars close to the globular cluster NGC6934 in Delphinus. So the first two comets I had seen (plus the first nova) were found accidentally and my SAS MOS colleagues joked that Charles Messier kept finding deep sky objects while looking for comets, whereas young Toone had a habit of doing exactly the opposite. These independent finds at the age of 14 - 15 using just the naked eye and binoculars convinced me that astronomy was a science well worth pursuing even as a mere amateur.

The North Western Association of Variable Star Observers (NWAVSO) 1976 – 1981

In May 1976 Colin Henshaw gave a presentation on his fledgling variable star association the NWAVSO to a meeting of the SAS MOS. I immediately joined the NWAVSO and this added impetus to my initial variable star work. In 1975 I had made just 22 observations of variable stars but in 1976 I did 75 and in 1977 it increased to 252. By 1981 I was doing in excess of 4,000 observations per annum and that level has been pretty much maintained ever since. Working within the NWAVSO meant that I learned how to properly record observations, undertake data analysis and prepare reports on variable stars. In 1979 Colin Henshaw appointed me to the position of 'Recorder' within the NWAVSO which meant that I received and collated the observations and produced 10 day mean reports for publication in the NWAVSO Journal 'Light Curve'. Also in 1979 I started to draw charts and develop sequences for variable stars. In 1981 the NWAVSO folded and was absorbed by the BAA VSS and part of the merger deal was that I would be appointed a VSS officer immediately upon being elected as a member of

the BAA.

BAA VSS & Charts/Sequences - 1981 Onwards

Doug Saw the BAA VSS director soon found me a task to perform when Rod Lyon said he could no longer draft the main programme charts. Coincidentally I had started my professional career as an electrical draughtsman at GEC in Trafford Park, Manchester in 1981 and drawing VSS charts was not at all difficult for me. So by 1982 I found myself drawing the charts for the main programme stars whilst Melvyn Taylor continued to draw the binocular programme charts. In 1987 I assumed the position of Chart Secretary from John Parkinson and became responsible for all of the VSS charts including sequence preparation, chart draughting and chart distribution. John Isles the incoming VSS director was keen to standardise the chart format because in 1987 multiple formats were being used (due in part to the earlier amalgamation of the Binocular Sky Society and NWAVSO with the BAA VSS) and it became my task to implement the standard format agreed upon by the VSS officers in that year. This format included my proposal to incorporate BS308 for text and general layout. Between 1982 and 2010 I prepared sequences for 196 stars and drew 297 charts for the BAA VSS. Prior to the charts being posted to the BAA VSS website in 2005 I processed 342 observer requests for paper copies of the charts.
Sequences can be an emotive subject and I received a lot of correspondence from observers some of whom had difficulty with VSS sequences. Upon analysis of the adverse feedback I found that most of the problems related to different coloured stars within the sequences and it seemed to me that this was due to the differing colour responses of individual observer's eyes. The solution was simple, limit the colour range within the sequence where practical (this policy was also adopted by the AAVSO chart team from 2006 onwards). The other problem I encountered was the lack of accurate V (& B) photometry for many variable star sequences. This problem was eventually resolved by the Hipparcos/Tycho mission, the work of Arne Henden at the USNO & AAVSO and the advent of CCD's with V filters that became readily available to amateurs. Only now in the 21st Century are we able to produce the accurate, linear & limited coloured sequences that the visual observer of variable stars requires. I believe passionately that visual observers should be given the best possible sequences to work with because when a quality observer uses a quality sequence then the output is (not surprisingly) quality data. For the future I consider it to be my duty to ensure that the BAA VSS sequences are of the optimum quality so that in time all the BAA VSS data dating from 1900 can be transformed to the modern V photometric scale that is confined within the error range of visual photometry itself.

My Observing Sites

Up until December 1992 I was based in Boothstown just seven miles west of Manchester city center where I experienced 12% clear, 32% partly clear and 56% cloudy nights. Conditions were never particularly good due to light pollution but became steadily worse towards the end of the 1980's as the town developed with additional housing & lighting being installed. Towards the end of 1991 the situation became intolerable when the local

council installed a new streetlight that virtually hung over the garden area from where I observed. Despite protestations and a press campaign (the Manchester Evening News story title was ‘Lights put astronomer in the dark’) the local council won the day on ‘safety & security grounds’. This reasoning proved totally unfounded because there were no reported road accidents in the vicinity and the property was actually burgled twice shortly after the streetlight was installed. Nevertheless, I was forced to find another site relatively free of light pollution to continue my astronomy. Fortunately in 1992 I was appointed as a project manager for ABB based in Telford and this was a timely opportunity to relocate from the Manchester area and find a darker observing site. Throughout the summer of 1992 I drove around Shropshire looking for properties for sale in the dark areas depicted on the nighttime satellite photo of the UK. I found a suitable site on the southern and highest limit of the village of Cressage eight miles south east of Shrewsbury. The only lights in the village were to the north at lower altitude and the sky glow from Telford was masked by the Wrekin Hill. Shrewsbury is in the rain-shadow of the Cambrian Mountains and has marginally better weather than Manchester with nights being 14% clear, 31% partly clear and 55% cloudy. The River Severn which snakes past the northern edge of Cressage is not a problem as mist is normally localised in the shallow river valley. I took residence in Cressage in January 1993 and it has proved to be an adequate site for astronomy purposes.

My Observing Instruments

My first telescope was the 6cm refractor that my parents gave me as a Christmas present in 1972. This was mothballed in April 1981 when I purchased a C8 schmidt cassegrain which has been the mainstay of most of my telescopic observations ever since. Despite being transported around the Australian Outback a couple of times and being physically carried during each observing spell it has never required re-collimation. Aside from being robust it is easily handled and transported. It has a limiting magnitude of around magnitude 14.5 from Shrewsbury but I have glimpsed magnitude 16.0 from the Australian Outback. I had a 16 inch dobsonian reflector from 1987 to 1992 but it proved awkward to handle within the observing site that I had in Manchester. Nevertheless, I hired a van to transport it onto the Pennine Mountains to get a last glimpse of Halley’s Comet in May 1987 and it did permit me to see Pluto fade slightly due to a Charon transit in April 1988. In 1996 I purchased a C14 schmidt cassegrain which became operational only in 1999 after I had extended my garage and patio in Shrewsbury to accommodate the wheeled tripod. The C14 can reach magnitude 16.6 on a very good night but it is only used if the variable object is too faint for the C8. Aside from telescopes I am a great fan of binoculars because they are so easy to use and it is a huge benefit to be able to use both eyes. The direct and wide field of view is a particular advantage for variable star work. From 1975 to 2005 I employed exclusively 12x50 binoculars which were manufactured sometime in the 1960’s. They were replaced by three new pairs; 7x50, 12x50 and 15x70 in 2006. Subject to reasonable sky conditions the 7x50 will be used between magnitudes 5 & 7, the 12x50 between magnitudes 7 & 9 and the 15x70 from magnitude 9 to 10. Below magnitude 10 I switch to the C8 and below magnitude 14 I usually switch to the C14. For red variables I try to minimise the switching of instruments where practical. A typical observation which involves writing down the full estimate details will take 1

minute with binoculars, 2 minutes with the C8 and around 3 minutes with the C14.

My Observing Strategy

With the exception of eclipsing binaries I consider myself to be an all-rounder in terms of the types of variable stars that I follow. I make every effort to monitor the stars on my observing programme systematically because I do not like to see gaps in my light curve data. This has led me to limit my priority and primary observing programmes to 143 relatively bright stars, many of which I have been following in excess of 30 years having recognized that the longer the observational baseline the more scientifically useful the data becomes. Overall I have three observing programmes:

1. Priority - 28 eruptive stars, RCB stars and blazars which are observed at every opportunity. If caught on the rise some dwarf novae (particularly AB Dra and SU UMa because of their rapid rate of rise and circumpolar nature) might be observed on two or more occasions during a single night.
2. Primary - 115 mainly red stars which are observed 3 nights a month (weather permitting) around the target dates of 5^{th}, 15^{th} & 25^{th}. Exceptions to this are when certain LPV's or RV Tauri stars are rising rapidly and more frequent observations are required to evenly populate the light curve.
3. Secondary – Approximately 40 miscellaneous stars which are observed only occasionally just to check if any unusual activity is underway.

The vast majority of stars that I monitor are taken from the official observing programmes of the BAA VSS.

In making visual estimates I prefer the fractional method to bracket the variable between comparison stars because I believe it to be more accurate and linear than the step method. I limit the number of fractions to a maximum of six and if there are large intervals in the sequence I sometimes switch to doing step estimates but never exceed five steps.

Aside from variable stars I also like to observe other variable objects including planets, asteroids and comets. I have a special interest in AGN's because it has been a neglected area for systematic monitoring in the past and also because of my earlier interest in deep sky objects and galaxies in particular.

To limit gaps in light curves I especially like to observe in the mornings when there is less light pollution emitted from households and the moon. During the long winter nights I may have three observing sessions: early evening, late evening and late morning; to ensure the whole sky is covered. Like most observers I begin in the western sky and work eastwards unless the observing session begins or ends in twilight/moonlight in which case I might vary it to avoid the brighter areas of the sky. I tend to cover the variables on a constellation sequential basis so that it reduces the risk of inadvertently missing anything during an observing session. Weather permitting I have two categories of nights for planned observing: 1) priority programme stars, observed every clear or partly clear night; and 2) priority and primary programme stars, observed just three times a month. If the night is only for priority stars then I may make typically 20 observations. If it is a night for covering all programme stars then the number of observations may on occasion exceed 100. The UK seasons heavily influence the nightly totals and it is rare that I obtain 100 observations in a single night in the month of June due to there being just 2 hours of relative darkness. Between 1981 and 2010 there have been 219 nights where 100

observations or more have been secured.
I travel frequently (both business & leisure) and try when practical to take my binoculars and occasionally the C8 telescope with me. This has resulted in variable star observations being made overseas from Australia (NSW, NT, Queensland & SA), Azerbaijan, Barbados, Canary Isles (Fuerteventura, Gran Canaria, Lanzarote & Tenerife), Denmark, The Gambia, Greek Islands (Corfu, Crete & Cyprus), Iceland, Kenya, Norway, Sweden, Switzerland, USA (Alabama, Hawaii & New Mexico) & Zimbabwe.
I have no plans to switch from visual to CCD photometry in the foreseeable future and with that in mind I trust that I will be remembered as one of the last of the dwindling number of systematic visual variable star observers.

Observing Statistics & Records

Between 1975 and 1992 I made 439 deep sky and 52,952 variable star observations in 2016 hours whilst based in Manchester and from 1993 to 2010 I have accrued 90,357 variable star observations in 2699 hours whilst based at Shrewsbury.
My highest total of variable star observations for a single nights work in the UK is 223 on the 3rd December 1999 which was undertaken in four spells over a total time span of 530 minutes. My record for a single nights work overseas was 139 on 16th March 1999 from Cunnamulla, Australia which was accomplished in a single spell lasting 385 minutes. My longest continuous observing spell was for 440 minutes on 17th April 1986 from Katherine Gorge, Australia when I clocked up 100 observations for the first time in a single night overseas.
In terms of geographical extremes I have observed at locations between 64N (Iceland), 33S (Australia), 156W (Hawaii) and 151E (Australia). The closest I have observed to the Equator is 4S from Mombasa, Kenya.
The highest altitude I have observed from is 2,800 metres at Mauna Kea, Hawaii although I have seen aurorae, NLC and an Algol fade whilst in flight over the Atlantic Ocean at 10,000 metres. The lowest altitude I have observed from is 28 metres below sea level at Baku, Azerbaijan.
The coldest temperature that I have observed in was -27C from Vasteras, Sweden on 13th February 1996. The warmest temperature that I have observed in was 30C from Huntsville, USA on 20th July 2003.
The brightest observation I have made is of the planet Jupiter at magnitude -2.3 from Siding Spring Observatory on 8th April 1986 when I used Alpha Centauri and Fomalhaut as comparison stars. The faintest reliable observation I have made was of SW UMa at magnitude 16.6 on 9th April 2007 from Shrewsbury with the C14.
The star that has exhibited the greatest variation is Chi Cyg with an observed range in excess of 10 magnitudes between magnitude 4.0 and 14.3. I suspect that the lower limit may be even fainter because astonishingly the sequence has not yet been measured with a CCD. The star in which I have seen the smallest reliable variation range is R CrB when at maximum in which pulsations in the order of 0.2 to 0.3 magnitude have been regularly detected.
The most rapidly changing star I have observed (excluding instances of flickering) is the dwarf Cepheid SX Phe. From Gran Canaria in September 1981 it appeared to have a maximum rate of change of 0.1 magnitude/minute.

Flickering has been seen in RX And, AB Aur, S5 0716+71, AB Dra, U Gem & Markarian 421 with that observed in U Gem being by far the most extravagant.
Since moving to Shrewsbury my annual total of observations has ranged between 4000 and 6000. By only following 28 eruptive stars coupled with 55% of all nights being non usable means that an upper limit of 6000 observations annually is imposed. The principle factors which influence the actual annual totals are business & family commitments and to a lesser extent the weather.

My Favourite Stars

Being an all-rounder I don't have a single favourite star; I have instead a set of favourite stars and one AGN. In constellation alphabetical order I would single out the following as my favourites:

Z Cam: The only truly circumpolar cataclysmic variable that can be followed throughout its full range in an 8 inch telescope. Consequently each year it normally tops my list for the star with the most observations. In 2007 I observed it on 171 nights (23 nights in April alone) and between March 1982 and December 2010 I observed it on 3032 nights. Entering and leaving the standstills is still an area of particular importance for observers to focus on.

Mira: The longest known conventional variable star with a rich history. It was the subject of my first observation in 1975 and the rise between magnitudes 8 and 5 is often most spectacular. I endeavour to observe it on 3 nights each month but increase the frequency during the steep rise phase. Because it has a negative declination south of the Ecliptic it is lost from the UK between mid March and mid July. However, from overseas I have secured observations as late as 25 March 1999 (from Australia) and as early as 5 June 1984 (from Barbados). With Mira not being visible for one third of the year and by limiting my observations to normally 3 nights per month I have only recorded observations on 735 nights between January 1975 and December 2010. The 2007 maximum was the brightest for 100 years with Mira briefly becoming the brightest star in Cetus. My favourite observation of Mira was on the 8th August 2009 within 3 hours of the birth of my daughter Miranda.

R CrB: Detecting fades is still almost exclusively in the visual observer's domain and once underway the depth can vary between 0.5 and 9 magnitudes. Minor pulsations of up to 0.3 magnitude at maximum around magnitude 6 have been picked up visually at intermittent intervals. The fade commencing in 2007 was the deepest on record eventually bottoming out at magnitude 15.1 and the onset was seen visually to coincide with the descending phase of the pulsation. Being favourably positioned and a bright binocular object when at maximum, has led me to observe it on 2700 nights between May 1975 and December 2010. My best month for observing R CrB was August 1995 when I secured observations on 23 nights. The best yearly total was 1995 with 127 nights of data. My 100,000th observation was of R CrB from Hawaii on 4th July 2002 when the locals kindly set off a few fireworks.

T CrB: The brightest recurrent novae could erupt at any time now and when it does it will be a naked eye object within a few hours. The two known outbursts in 1866 and 1946 were first seen from the British Isles, so it is well worth monitoring even from the cloud prone UK. Cyclic variations are detectable visually at minimum with minor flare ups occasionally superimposed caused by the unseen fainter blue component. My best months for observing T CrB were August 1995 and April 2007 when I secured observations on 20 nights. The best yearly total was 2007 with 129 nights of data. Between May 1981 and December 2010 I have made observations of T CrB on 2326 nights.

U Gem: Known for 41 years before any other dwarf nova was discovered it was well studied by 19th & 20th Century visual observers. The 5 magnitude rise to outburst within 24 hours is simply quite breathtaking and may sometimes be accompanied by extravagant flickering. The second outburst that I saw in 1985 was the longest on record at 43 days whilst the third in 1986 was the shortest on record at 6 days. My most memorable observation of U Gem was on 4th June 2006 from the coast of Cornwall when it was just detectable in outburst at magnitude 9.6 above the twilight threshold whilst a badger in close proximity behind me was making threatening noises. On 7th April 1992 I found the asteroid Nysa within the field of U Gem. On 21st January 2000 I secured a mag 14.2 observation of U Gem with the C8 whilst the moon was just 4 degrees away undergoing a total eclipse. U Gem is non circumpolar and positioned right on the Ecliptic and is lost from the UK between early June and mid August. My latest observation prior to solar conjunction was in 2006 (mentioned above) and my earliest post solar conjunction observations are 22 August 2009 (negative at <12.0) and 25 August 2007 (positive at 9.7). My best month for observing U Gem was April 2007 when I secured observations on 20 nights. The best yearly total was 2007 with 103 nights of data. Between November 1981 and December 2010 I have made observations of U Gem on 1614 nights.

RS Oph: The second brightest recurrent nova shows a lot of activity at minimum especially when just preceding an outburst. Its light curve very much reminded me of activity seen in an Icelandic geyser I watched in 2004. On 31st July 1984 I found the asteroid Kleopatra within the field of RS Oph. Despite being positioned south of the equator it can be seen throughout the year apart for a month centered on the Winter Solstice and I always make a special effort to observe it during the morning apparition from January to March because the last three outbursts have occurred within these months. My latest observation prior to solar conjunction was on 4th December 1996 and my earliest post solar conjunction observation was on 4th January 2000. My best month for observing RS Oph was August 1995 when I secured observations on 20 nights. The best yearly total was 1995 with 107 nights of data. Between March 1982 and December 2010 I have made observations of RS Oph on 1737 nights.

Markarian 421: Was known as the brightest BLAZAR until S5 0716+71 was recognised. The close proximity of 51 UMa is an aid to the visual observer but a hindrance to the CCD observer. Rapid variation including flickering can be seen visually and it can be followed throughout its range under good conditions with an 8 inch telescope. The 1992 outburst I reported visually coincided with TeV emission being

detected from an AGN for the first time and resulted in some early ProAm exchanges. Between April 1981 and December 2010 I have made observations of Markarian 421 on 1347 nights with 1999 (84 nights) being my best year and April & May 2007 (18 nights in each) being my best months.

Observing Hazards

I have encountered the following hazards whilst undertaking astronomical activities. Fortunately none have so far caused personal injury or permanent damage to my observing instruments.

Earthquake - Kenya

Rain during clear skies – Multiple sites

Lightning spoiling night vision – NSW & Queensland, Australia

Snake warning me off – The Gambia

Badger warning me off - Cornwall

Slipping on crushed snails (according to Colin Henshaw I have 6 species of snail in my garden) – Shrewsbury

Tripping over 6 inch long snails - Kenya

Slipping on crushed cockroaches – Canary Isles

6 inch centipede crawling up my back - Barbados

Inquisitive wallaby & emu – NT, Australia

Bat droppings on front optics of C8 & C14 - Shrewsbury

Police stopping vehicle during overnight journey and checking contents (honest officer, it's just a telescope in my boot) – Cumbria & Wales

Being followed by plain clothes police (possibly ex KGB) - Azerbaijan

Misjudging proximity of cliff face – Cornwall

Being a visual observer fully exposed to the elements is not without risk. I do hope that the sky gods continue to look upon me favourably.